Workman's Tool For Accessing Cavities

BACKGROUND OF THE INVENTION

The present invention is directed to a tool used for opening hollow core walls and ceilings to allow access to the interior space of the wall or ceiling. The device includes a replaceable conventional pilot drill bit, a replaceable circular hole-cutting blade, frequently referred to as a "hole saw," a flange member and a series of rebate blades located at angular positions on the flange.

A common manner for the construction interior walls in homes and office buildings is the attachment of gypsum board, also referred to as drywall and sheet rock, to structural members including studs, trusses and joists. Gypsum board is attached to upright studs to form walls and on the bottom of joists or trusses to form ceilings. These structural members are spaced at regular intervals and thereby this construction creates spaces between structural members. For example, in typical construction in the United States studs used in walls are spaced at 16 inch intervals. When the framing stage of construction is complete, mechanical contractors, including plumbers, electricians, phone service technicians, and heating and air condition workers may install lines and equipment within the walls. These lines may include phone lines, cable television lines, gas lines, water and sewer conduits, vacuum lines for central vacuum and heating and air conditioning ducts and control lines. When the mechanical contractors have completed the installation, insulation is installed in the exterior walls and top floor ceiling areas. Next gypsum boards are attached to the exposed studs and joists using glue, nails and or screws. After the gypsum boards have been installed, the surface is finished using tape

and joint compound. Finishing the gypsum board results in a smooth, continuous and seamless surface.

Frequently, after the finishing work as described above has been completed, there is a need to install additional components within the finished walls. A homeowner or tenant may also have a need to access internal lines to make repairs. For example, it may be desirable to add insulation to walls that border the exterior of a completed structure. In order to introduce insulation to these spaces, holes must be temporarily created within each cavity. In any event, the installation of new components within the walls and ceilings, or accessing existing components within the walls, requires cutting open the walls to provide such access. Upon the completing of the job, the access hole must then be patched and the surface refinished. One conventional manner in which to patch holes requires cutting the access hole so that two adjacent structural members are revealed. Then a piece of drywall is cut to closely conform to the opening and attached to the adjacent structural members. One disadvantage with this technique is that it is difficult to apply the joint compound over and within the seam between the abutting edges without creating a bulge around the patch. While the bulge can be slowly tapered out to make the repair almost imperceptible, this procedure involves additional finishing work, and may require multiple applications of the joint compound. This technique also requires the creation of fairly large access opening. An alternative repair technique taking a short piece of lumber and inserting the lumber through the hole and then, attaching the lumber on opposite sides of the opening with a drywall screw so that the lumber spans the hole. A patch is then cut and attached to the lumber. This technique allows a smaller hole to be

created but still requires cutting a patch to closely conform to the hole and the problem of finishing the surface without a bulge is not avoided.

Another problem with cutting though these surfaces with conventional power tools is that the technician runs a risk of inadvertently cutting into the lines. The accidental rupture of a power line or water line can leave considerable remedial work to reinstate the walls or flooring.

Although there a number of approaches to the problem of accessing interior spaces, including those not described in detail herein, there is a need for alternative and improved manners in which to access and patch hollow core structure. Preferably this access and subsequent patch and replacement procedure can be performed with a minimal amount of time, effort and expense.

SUMMARY OF THE INVENTION

The present invention is directed a tool and method of repair that allows the rapid access to hollow core walls and ceilings in manner that enable the hole to be quickly formed and then repaired. According to the invention, a hole saw designed for use on a drill, is provided with a rear flange attachment on which is provide a series of rebate blades. The hole saw is rotated and creates a hole through the surface of a sheet substrate in a conventional manner by penetrating substrate. Continued axial movement of the device in the direction of the substrate causes the rotating rebate blades located outside the hole saw to then come into contact with the surface of the substrate. The rebate blades engage the surface, penetrate the substrate, and remove a portion of the substrate to form an annular cavity outside a though-hole that is formed by the hole saw. Further axial movement towards the substrate causes a flange to engage the surface of the

substrate and prevents further axial movement. The device is then removed from the wall and a hole having an annular cavity around the periphery of a through-hole is the resulting structure. The technician is then free to access the interior space and later provide a patch that can be seated in the annular cavity.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a top view in elevation of the flange portion of the invention.

Fig. 2 is a side view in elevation of the flange part of the invention also showing the pilot drill bit.

Fig. 3 is a bottom view in elevation of the flange part used in connection with the device according to the invention.

Fig. 4 is a top view in elevation of the hole saw used in connection with the present invention.

Fig. 5 is a side view in elevation of a hole saw used in connection with the invention.

Fig. 6 is a side view in elevation of the assembly of the device according to the invention that includes the flange, the hole saw and drill bit.

Fig. 6b is a perspective view in elevation of the hole saw, drill bit and flange assembly.

Fig. 7 is a side sectional view of the invention next to a hole that is formed through a substrate using the device according to the invention.

Fig. 8 is a side sectional view of a patch received in a hole in a substrate that was formed by the device according to the invention.

Fig. 9 is a side sectional view of an alternative patch received in a hole in a substrate formed by the device according to the invention.

DETAILED DESCRIPTION OF THE SPECIFIC EMBODIMENTS

Now referring to Fig 1 a top view of the flange portion of the invention is depicted. A the center of the flange part 30 is hexagonal shank 10 that is comprised of metal and is designed to be received on the head of a conventional drill. The drill, which may be either powered or manual, rotates the entire assembly via the shank. Four through-holes 12 a-12d are provided to received fasteners, such as screws, that engage and attach the hole saw through opposite holes 101a –101d. Holes 101a-101b are provided through the rear endwall 22 surface of the hole saw 18 . Flange member 30 is domed shaped and serves to stop the device from penetrating the wall and prevents dust and debris from flying back into the vision of the user of the tool. Fig. 2, a side view of the flange assembly, further shows an axial passage 14 that receives a thumbscrew. The thumbscrew, not shown, engages pilot drill bit 16 that is received in a central cylindrical sleeve 18. Pilot bit 16 is the first part of the device that engages the surface into which a hole is to be formed using the device according to the invention and provides stability to the assembly when the blades of the hole saw engage the surface. A seen in Fig. 3, the bottom of flange member has four rebate blades 5a-5d attach thereon. Center sleeve 18 that received the drill bit is also depicted.

The cylindrical hole saw 18 according to the invention is depicted in Figs. 4 and 5. Fig 4 shows a top elevational view of hole saw 18 having sidewall 20 and end wall 22. Provided through end wall 22 are through holes 101a-101d that are used for the attachment of the hole saw 18 to the flange member 30 by an appropriate affixing means

including screws or bolts and nuts. At the center of hole saw 18 is an opening or sleeve 24 through which the pilot drill bit is received. As seen in Fig. 5, hole saw 18 has a cutting surface 26 that is designed to engage and cut into the surface of a substrate. Lateral holes 28 and 29 are provided through the sidewall 20 in order to enable a user to remove a circular plug that is cut by the hole saw from the interior potion of the of the cylinder.

Fig 6a depicts the assembly of the components including the flange member 30, hole saw 18 and pilot drill bit 16. As best seen in Fig. 6b, the four rebate blades 5a-5d are axially positioned on bottom side of the flange member 30 near the edge of the flanges and adjacent to hole saw 18. In the embodiment depicted in Fig. 6b the rebates blades are shown to have an "L shaped" profile wherein one surface is parallel with and is affixed to the bottom surface of flange member 30 and the other surface of the blade extends in an axial direction. The end of the rebate blade that extends in the axial direction is designed to engage the surface of the substrate. While in the specific embodiment depicted herein, the rebate blades are affixed to the bottom surface of the flange 30, in an alternative embodiment of the invention the rebate blades may be attached to the outside of the hole saw. In yet a further contemplated embodiment the rebate blade consists of a second cylindrical hole saw directly adjacent, outside of, and concentric with an inner hole saw. The rebate blade or blades are formed of metal and are designed to cut into or abrade the surface of the substrate that is to be accessed and to create an annular cavity around the circumference of the through hole. The trough hole is formed by the hole saw.

Fig. 7 depicts a sectional view of the invention directly above a hole that is formed by the tool wherein the shank 10 is engaged by drill head 50. In preferred embodiments, the axial length of the side wall of the circular from the cutting surface is selected to be approximately the same as the thickness of the substrate to be accessed. By selecting a hole saw having a sidewall with an axial length the same as the thickness of the substrate, the risk of accidentally cutting into materials or lines contained within the wall or ceiling is significantly reduced. In operation, the pilot drill bit 16 first engages the surface of the substrate and penetrates the material. The pilot drill bit helps align the tool and maintains stability of the tool when the hole saw engages the surface of a substrate. Next the cutting surface 26 of the hole saw engages the surface 65 of the substrate 80 and begins to abrade the surface in an annular ring. Continuing axial movement of the assembly causes the cutting surfaces 70 of the rebate blades 5a to engage the surface of the substrate at a location just outside the engagement areas of the hole saw. The rebate blades 5a-d, like the cutting surface 26 of the cylindrical hole saw 18, penetrate the surface 65 and abrades the material away. As the assembly continues to move in an axial direction, surface 61 of flange 30 engages the top surface 80 of substrate 80. The engagement of the flange to the top surface of the substrate prevents further axial movement of the assembly.

To repair the hole made by the device, a complementary disk shaped patch 120 is provided that closely conforms to the dimension of the hole. Referring now to Fig. 8 patch 120 may be made of a thin fiberboard having an axial dimension that closely conforms to the annular cavity 90 or, as shown in Fig 9, may have a stepped axial dimension wherein an outer annular region 152 of the patch has a thin axial dimension

that is received in the annular cavity 90 and a thicker central core region 154 that is received in the though hole that was created by the hole saw. In any event, the annular cavity serves to receive patch and secure it in place by providing a surface 92 wherein the patch may be seated. The patch is then is further secured using adhesive and/or conventional joint compound.

In a preferred embodiment the invention, the device creates a hole large enough for the technician to inset his or her hand inside the cavity. Once the work is completed a pre-manufactured hole cap or patch is affixed within the hole to reinstate the floor, ceiling or wall. In addition to gypsum or plaster board as described above, it is further contemplated that the invention may also be used to used to cut into chipboard or plywood flooring or other wood surfaces as well as materials made of synthetic resin or fiber. A variety of complementary patches may be provided that can be made of any materials that are intended to be engaged by the tool. Indeed, almost any surface may be penetrated by the device, including stone and tile, in the event that the appropriate hole saw and rebate blades are used. In each of the contemplated uses, a patch can then be set in the hole that results from use of the tool.

It should be further appreciated that flange member does not have to rotate in order to practice the invention. For example the blade may be affixed to rotating hole saw rather than the flange. In such an alternative embodiment the flange may still serve as protective shield and as a manner in which to control the depth of penetration of the tool. In yet a further embodiment, a single hole saw having two concentric cutting surfaces may be used, with a flange portion, behind the second outer surface to serve as a stop.

Once again referring to Fig. 7, a first embodiment of a patch that can be used with the invention is merely a disk that can be inserted to the top portion of the hole created by the tool. In this embodiment, the patch is seated in the annual cavity created by the rebate blades and spans the hole created by the hole saw. The top surface 62 of the patch is within the same plane as the exterior surface 65 of the gypsum board. Fig. 9 shows an alternative patch having two axial dimensions. The outer edge region 152 has a dimension that approximates the depth of the annular cavity formed by the rebate blade and the central core region 154 extends into the through hole that was formed by the tool. The patch depicted in Fig. 7 has a dimension at the center core that is the same as the substrate. This alternative patch may be used in situations where both sides of the may be finished and further, and gives additional structural strength to the wall.

It should be appreciated that the dimensions of the hole saw, including the axial length and circumference, as well as the distance between cutting surface of the rebate blades and the cutting surface of the hole saw may be altered depending on the intended application. The axial dimensions of the sidewall of the hole saw from the flange to the cutting surface may be altered depending on the thickness of the substrate that is to be penetrated. It should also be appreciated that while the specific embodiment depicted herein shows four rebates blades, that any number of rebate blades could be used to achieve the objects of the invention. One should also recognize that although a circular flange is depicted to stop the forward movement of the device, other mechanism could be advantageously employed to ensure that the rebate blades penetrate a predetermined distance. For example, the blade itself could be provided with a flange extension that would allow a predetermined axial penetration.